Moving Towards a User-Friendly EV Total Energy Cycle Model

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Document Infomation

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Table of Contents

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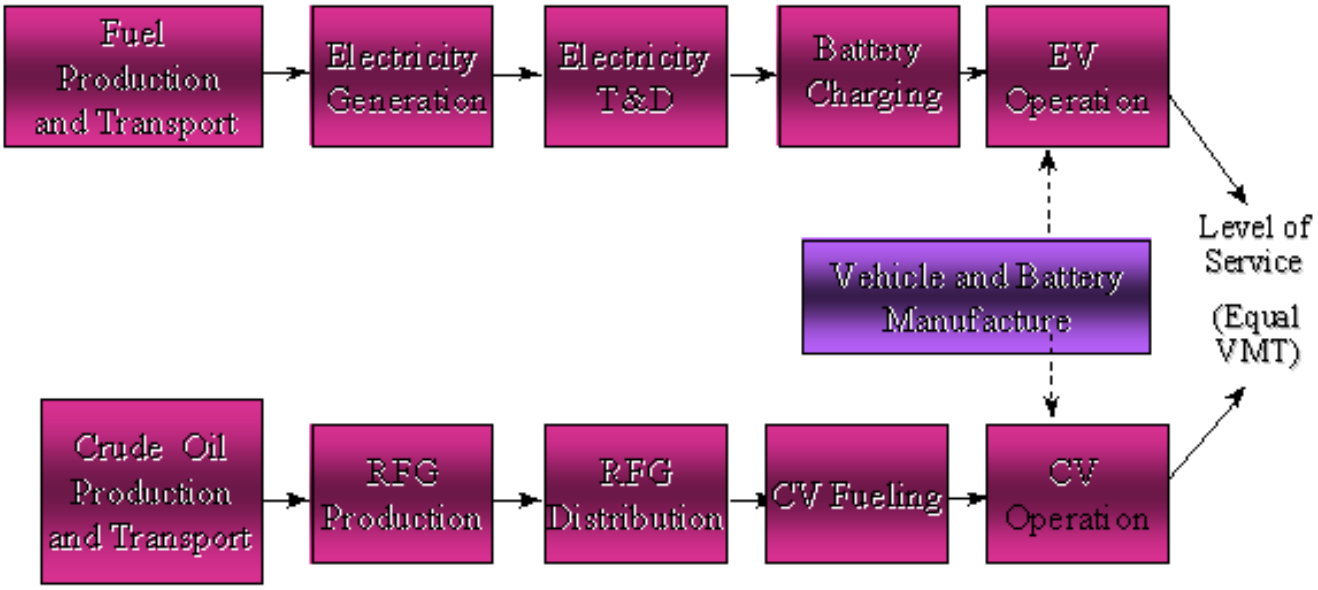
TRB Workshop
August 3, 1998

Background: Electric Vehicle Total Energy Cycle Assessment

- EVTECA sponsored by U.S. DOE
- Purpose: to provide estimates of changes in lifecycle energy use and emissions that would occur with the introduction of EVs
- For EVs and comparable CVs examined:
  - Energy use by type
  - GHG emissions
  - Criteria air pollutants

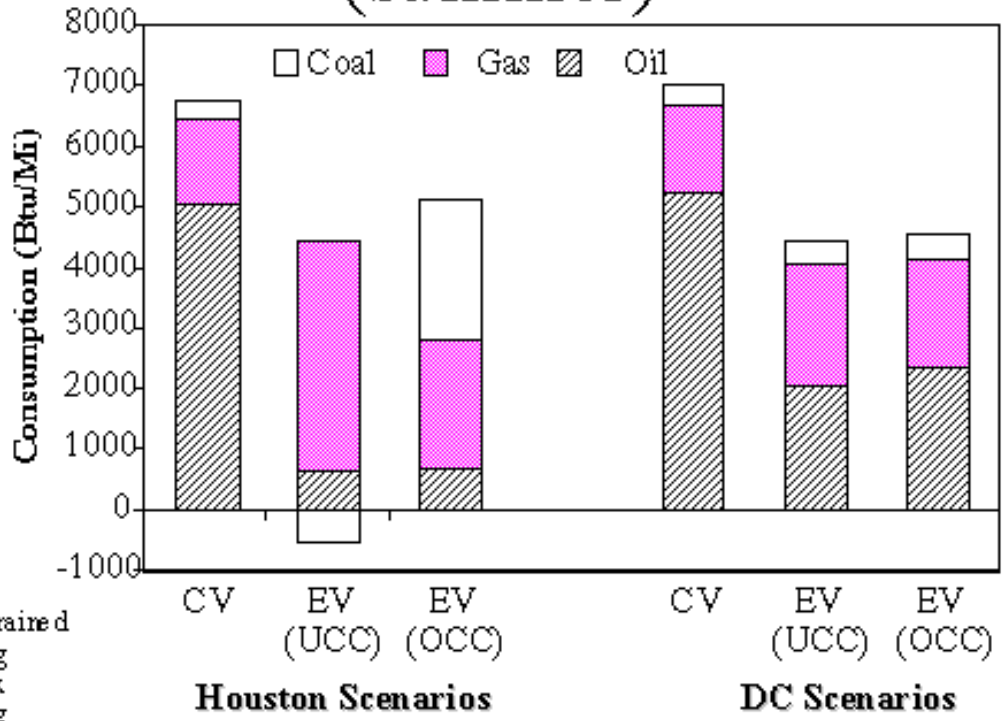
Stages in the EV and CV Energy Cycles



Completed TEC Analysis for Two Regions

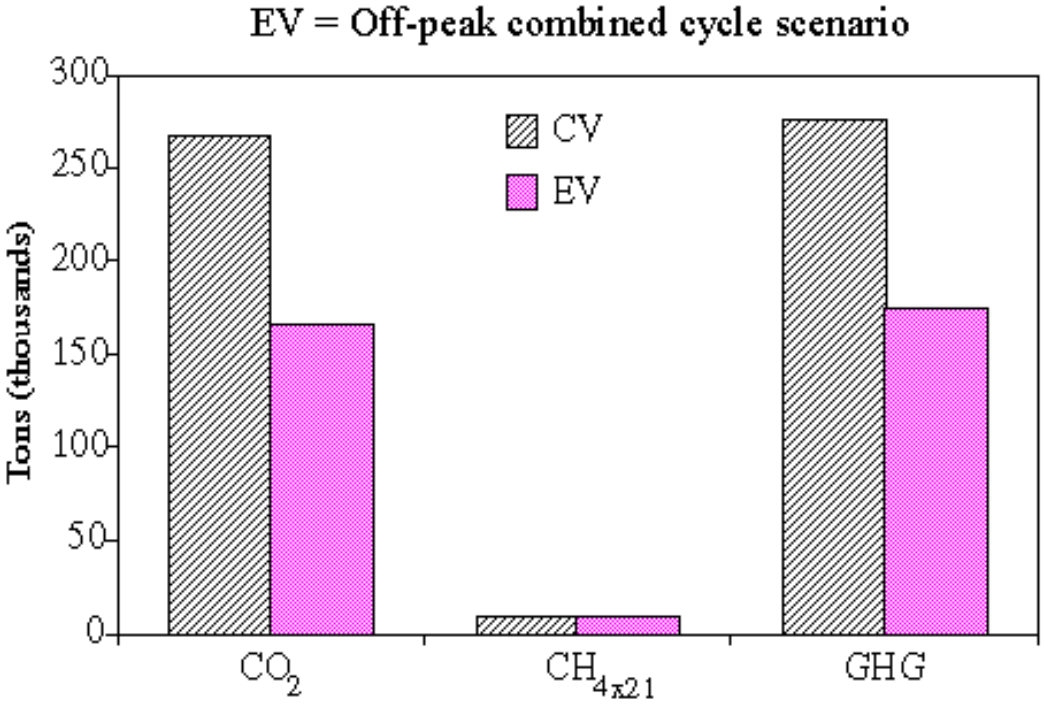
- Houston: 195,000 EVs in 2010
- Washington, DC: 140,000 EVs in 2010
- Characterized region-specific
  - EV and CV operating efficiencies
  - Daily travel
  - Marginal power plant fuels for EV charging
  - Reliance on in-basin electricity generation and gasoline refining

Energy Cycle Primary Energy Resource Consumption – 2010 (summer)

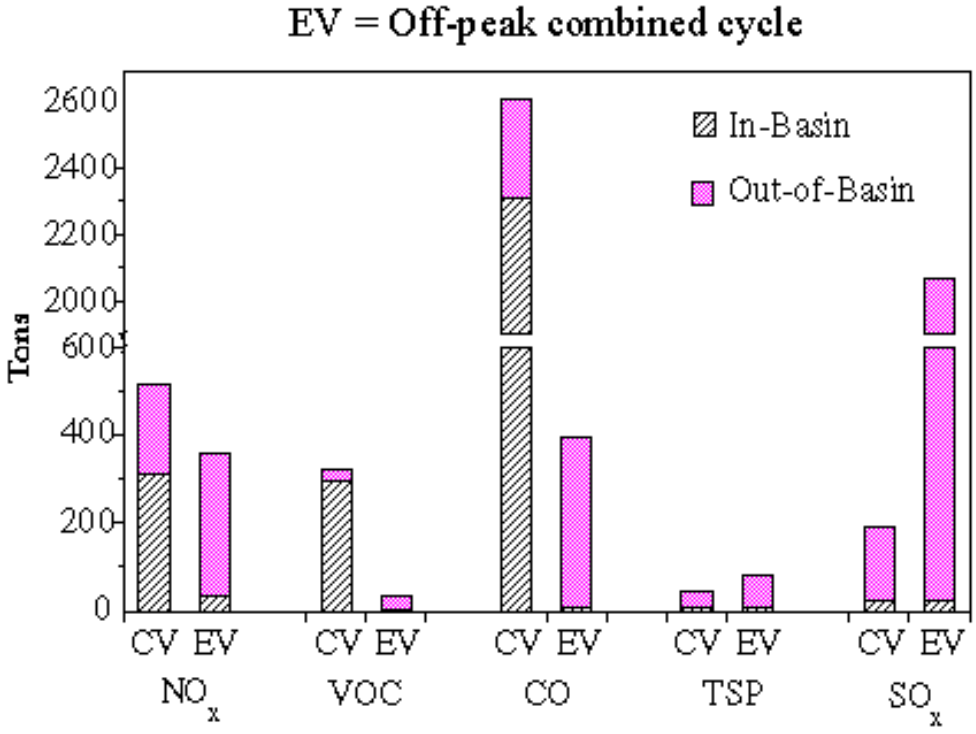


U Unconstrained Charging
O Off-peak Charging
CC Combined Cycle

Greenhouse Gas Emissions, Washington, DC (summer)

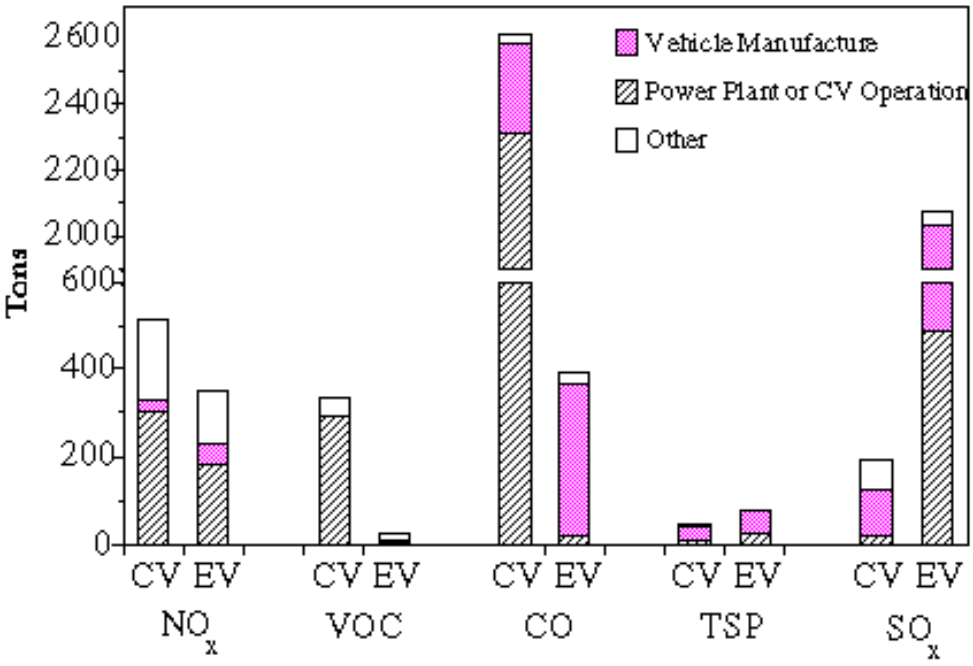


Energy Cycle Emissions: In-Basin and Total, Washington, DC (summer)



Energy Cycle Emissions by Stage, Washington, DC (summer)

EV = Off-peak combined cycle

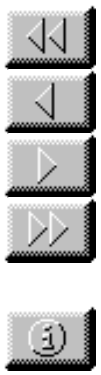


Impact of EV Use on Air Quality (per EVTECA Results)

- Ozone
  - VOC lower
  - NOx lower
  - CO lower
- Particulate Matter
  - In-basin TSP generally lower
  - In-basin SOx generally higher
  - Total TSP and SOx higher
- Acid Rain
  - SOx higher
  - NOx lower
- CO
  - CO lower
- Lead
  - Pb higher

Criticisms of EVTECA

- Battery technologies dated and did not account for recycling
- Characterized vans, not electric trucks
- EV energy efficiencies overly pessimistic / optimistic
- Impact of utility industry deregulation not considered
- *TEC model not flexible*



Response to Criticisms: Development of a User-Friendly, Flexible TEC Model

- User will be able to input own estimates of :
  - EV energy efficiency and CV fuel economy
  - Battery and vehicle types (within limits)
  - Power plant fuel mix for selected years
  - EV sales
- TEC impacts (energy, GHG, pollutants by location) of total EV use in a region will be generated for near/far term (2005/2015)

Status of Model Development

- In process
- Model consists of several linked Excel workbooks
- Based on ANL's GREET model, a stock turnover model, and selected data from EVTECA
- By end of FY, expect to have a working version with sample input for one region

Potential Application of Model in Air Quality Analysis

- EV impacts on regional air pollutant burdens (total and in-basin) will be estimated for near and far term
- Level of elevation of in-basin emissions probably will be estimated
- "Time of day" of EV emissions vs. those of CVs (for ozone analysis) might be estimated